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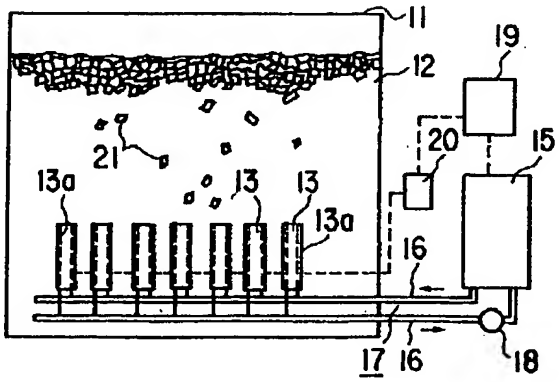
(54)【発明の名称】　氷蓄熱装置

(57)【要約】

【課題】簡単な構成にして確実な氷の離脱性能を得、更に製氷面への水の供給が全く不要になると共に、製造した氷を浮力にて上昇させ貯溜槽の上部に堆積させることができる。

【解決手段】貯溜槽１１内に収容された水１２を複数の製氷装置１３により凍結させて氷を製造し、この氷の成長に応じて製氷装置１３から離脱して貯溜槽１１内に蓄える氷蓄熱装置において、貯溜槽１１の底部に各製氷装置１３を設置し、その製氷面１３ａに貯溜槽１１内の水を凍結させて氷を製造する。



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【特許請求の範囲】

【請求項１】　貯溜槽内に収容された水を複数の製氷装置により凍結させて氷を製造し、この氷をその成長に応じて製氷装置から離脱して前記貯溜槽内に蓄える氷蓄熱装置において、

前記貯溜槽の底部に各製氷装置を設置し、その製氷面に前記貯溜槽内の水を凍結させて氷を製造することを特徴とする氷蓄熱装置。

【請求項２】　請求項１記載の氷蓄熱装置において、各製氷装置の製氷面に電気加熱手段を設け、前記製氷面で製造される氷の大きさが所定の大きさに成長したことを検知するか、あるいは所定の製氷運転時間が経過したことを条件に前記電気加熱手段を一定時間作動させ、製氷面を加熱して氷を離脱させることを特徴とする氷蓄熱装置。

【請求項３】　水が収容された貯溜槽と、この貯溜槽の底部に設置され、且つ内部に流入する不凍液の圧力が所定圧力になると外方に膨出可能な製氷面を有する複数の製氷装置と、前記貯溜槽の外部に設置され、前記製氷装置との間で不凍液を循環させる不凍液循環系が形成された冷凍装置と、前記不凍液循環系の前記製氷装置出口側に設けられた弁と、前記不凍液循環系の前記冷凍装置の不凍液流入側に設けられた不凍液循環ポンプとを備え、各製氷装置の製氷面に前記貯溜槽内の水を凍結させて氷が製造され、この氷の大きさが所定の大きさに成長したことを検知するか、あるいは所定の製氷運転時間が経過したことを条件に前記弁を全閉して、前記製氷装置の製氷面を前記不凍液循環ポンプの吐出圧により外方に膨出させて製氷面から氷を離脱させることを特徴とする氷蓄熱装置。

【請求項４】　請求項１乃至請求項３の何ずれかの項に記載の氷蓄熱装置において、貯溜槽の底部に複数の製氷装置を設置するに際し、各製氷装置を垂直方向に互いに重なり合わないように設置したことを特徴とする氷蓄熱装置。

【請求項５】　請求項１乃至請求項４の何ずれかの項に記載の氷蓄熱装置において、貯溜槽の底部に複数の製氷装置を設置するに際し、各製氷装置の片面のみを製氷面とし、且つこの製氷面を上向きにして設置したことを特徴とする氷蓄熱装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、夜間の割安な電力を利用して低温の熱源として利用可能な氷水を製造し、これを貯溜槽に蓄えることにより経済的な空調や冷熱供給を行うハーベスト方式（製氷装置にて氷の製造と脱氷を繰返し行う）の氷蓄熱装置に関する。

【０００２】

【従来の技術】従来のハーベスト方式の氷蓄熱装置は、製氷槽の上部に製氷装置を設置し、貯溜槽から絶えず水

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を汲上げ、垂直に設置された低温製氷面に振掛けて氷を成長させ、氷の成長後は製氷面を加温して板状の氷を落下させて貯蔵する方式や、皿状の製氷器に水を供給して氷とした後にこれを加温すると共に製氷装置を反転させて氷を落下離脱させる製氷手法を用いている。

【０００３】図７はかかる従来のハーベスト方式の氷蓄熱装置の構成例を示すもので、１は氷を貯溜させる貯溜槽で、この貯溜槽１の上部には製氷装置２が設置される。この製氷装置２の上部に貯溜槽１の底部より水循環ポンプ３により汲出した水４を配管５を通して供給する散水装置６が配置され、また下部には製氷された氷を粉砕して貯溜槽１に落下させる氷粉砕装置７が配置されている。

【０００４】また、この製氷装置２は冷凍装置８に循環路が形成されるように接続され、この冷凍装置８より供給される低温化された不凍液により散水装置６より散水された製氷面２ａの周囲の水を氷結させている。

【０００５】従って、このような構成の氷蓄熱装置にあっては、製氷面２ａから重力により落下した板状の氷は氷粉砕装置７により細分化されて貯溜槽１の上部に落下堆積すると共に、互いの氷間に隙間を持ちながら散在する。この結果、解氷に際しては無数の水の流路が氷間に形成され、極めて良好な熱交換が達成されることから低温の冷水を安定して取出せる利点を有する。

【０００６】

【発明が解決しようとする課題】しかしながら、このような従来のハーベスト方式の氷蓄熱装置では、製氷装置２の製氷面２ａで製造された氷を重力により貯溜槽１へ落下させているため、製氷装置２を貯溜槽１の上部に設置する必要があり、スペース的な制限を受ける等の多くの問題がある。

【０００７】即ち、製氷槽１の上部には３ｍ程度の製氷装置２の設置スペースと、さらにその下部に氷粉砕装置７の設置スペースが必要となる。また、製氷装置２の製氷面２ａに水を供給するための配管５、水循環ポンプ３、製氷面２ａで生成される氷が板状の場合には氷を細分化する氷粉砕装置７が必要となり、またブロック状の氷を生成する場合には氷を落下させるための製氷面反転装置等が必要となるため、スペース性、省エネ性の点で問題がある。

【０００８】さらに、貯溜槽１の上部に製氷装置２や氷粉砕装置７を設置する必要から、既存の水蓄熱装置を氷蓄熱装置に改造することは不可能に近い状況である。本発明は上記のような問題を解消し、確実な氷の離脱性能を得、更に製氷面への水の供給が全く不要になると共に、製造した氷を浮力にて上昇させ貯溜槽の上部に堆積させることができる構成簡単且つ信頼性の高い氷蓄熱装置を提供することを目的とする。

【０００９】

【課題を解決するための手段】本発明は上記の目的を達

成するため、次のような手段により氷蓄熱装置を構成するものである。請求項１に対応する発明は、貯溜槽内に収容された水を複数の製氷装置により凍結させて氷を製造し、この氷をその成長に応じて製氷装置から離脱して前記貯溜槽内に蓄える氷蓄熱装置において、前記貯溜槽の底部に各製氷装置を設置し、その製氷面に前記貯溜槽内の水を凍結させて氷を製造する。

【００１０】従って、上記請求項１に対応する発明の氷蓄熱装置にあっては、貯溜槽底部の水中に設置された製氷装置により氷が製造されると、この氷は密度差（浮力）により浮上すると共に、氷が浮上した後に水が自動的に供給されるので、貯溜槽上部には解氷用の散水ノズルを別として一切の構成物が不要となる。このことは既存の水蓄熱装置から氷蓄熱装置への改造が可能となり、また新規の氷蓄熱装置ではスペース効率の良いハーベスト方式氷蓄熱装置の提供が可能である。

【００１１】請求項２に対応する発明は、請求項１に対応する発明において、各製氷装置の製氷面に電気加熱手段を設け、前記製氷面で製造される氷の大きさが所定の大きさに成長したことを検知するか、あるいは所定の製氷運転時間が経過したことを条件に前記電気加熱手段により製氷面を加熱して氷を離脱させる。

【００１２】請求項３に対応する発明は、水が収容された貯溜槽と、この貯溜槽の底部に設置され、且つ内部に流入する不凍液の圧力が所定圧力になると外方に膨出可能な製氷面を有する複数の製氷装置と、前記貯溜槽の外部に設置され、前記製氷装置との間で不凍液を循環させる不凍液循環系が形成された冷凍装置と、前記不凍液循環系の前記製氷装置出口側に設けられた弁と、前記不凍液循環系の前記冷凍装置の不凍液流入側に設けられた不凍液循環ポンプとを備え、各製氷装置の製氷面に前記貯溜槽内の水を凍結させて氷が製造され、この氷の大きさが所定の大きさに成長したことを検知するか、あるいは所定の製氷運転時間が経過したことを条件に前記弁を全閉して、前記製氷装置の製氷面を前記不凍液循環ポンプの吐出圧により外方に膨出させて製氷面から氷を離脱させる。

【００１３】上記請求項２及び請求項３に対応する発明の氷蓄熱装置にあっては、製氷装置にて製造された氷を製氷面から離脱させる手段として、製氷面を電気的に加熱させる手段、あるいは機械的に製氷面を変形（膨らませる）させる手段を備えているので、製氷装置を水中に設置することにより発生する氷の離脱性の問題も解決でき、確実に氷を製氷面から離脱させることが可能となる。

【００１４】請求項４に対応する発明は、請求項１乃至請求項３の何ずれかの項に記載の発明において、貯溜槽の底部に複数の製氷装置を設置するに際し、各製氷装置を垂直に且つ互いに重なり合わないように設置する。

【００１５】請求項５に対応する発明は、請求項１乃至請求項４の何ずれかの項に対応する発明において、貯溜槽の底部に複数の製氷装置を設置するに際し、各製氷装置の片面のみを製氷面とし、且つこの製氷面を上向きにして設置する。

【００１６】上記請求項４及び請求項５に対応する発明の氷蓄熱装置にあっては、製氷装置から離脱した氷が水中に浮力にて上昇する際にも、製氷装置を垂直方向に互いに重ならないように配置しているため、各製氷装置から浮上する氷が製氷装置により阻害されることなく、スムースに浮上させることができる。

【００１７】

【発明の実施の形態】以下本発明の実施の形態を図面を参照して説明する。図１は本発明によるハーベスト方式の氷蓄熱装置の第１の実施の形態を示す構成図である。

【００１８】図１において、１１は水１２が収容された貯溜槽で、この貯溜槽１１内の底部には複数の製氷装置１３がそれぞれ並設される。これら各製氷装置１３は図２に示すように全体が箱形に形成され、その前後両面の縦及び横方向にそれぞれ複数の矩形状の製氷面１３ａが形成されている。

【００１９】これら各製氷面１３ａはその部分の板面をそれぞれ内方へ凹ましてその内周面に電気ヒータ１４が設けられている。また、製氷面１３ａの表面には例えばポリプロピレンの膜のような薄っすい撥水性のある薄膜を接着、あるいはコーティングして氷の離脱性を助長している。

【００２０】一方、１６は各製氷装置１３内部に不凍液を供給及び排出する不凍液給排出管で、この不凍液給排出管１６には各製氷装置１３の給排口が接続されると共に、外部に設置された冷凍装置１５に接続して不凍液を循環させる不凍液循環系１７が形成されている。また、冷凍装置１５の不凍液流入側の不凍液循環系１７には不凍液循環ポンプ１８が設けられている。

【００２１】また、１９は冷凍装置１５の運転及び各製氷装置１３の電気ヒータ１４を制御する制御装置、２０はこの制御装置１９からの指令により各製氷装置１３の電気ヒータ１４を一定時間間隔でオン、オフする製氷タイマーである。

【００２２】次に上記のように構成された氷蓄熱装置の作用について述べる。いま、制御装置１９からの制御指令により冷凍装置１５が運転されると共に、製氷タイマー２０が起動されると、冷凍装置１５より低温化された不凍液が不凍液循環ポンプ１９にて不凍液給排出管１６を経由して各製氷装置１３に圧送される。

【００２３】すると、製氷装置１３の製氷面１３ａは不凍液給排出管１６より流入する不凍液により低温になり、凹部内周囲の水１２を氷結させる。また、製氷タイマー２０が所定の製氷時間経過後に動作すると各製氷面１３ａに配設された電気ヒータ１４が通電される。

【００２４】これにより、各製氷面１３ａに固着してい

る氷ブロック２１の固着面が融解し、氷ブロック２１が浮力により製氷面１３ａから離脱して水中を浮上する。この場合、電気ヒータ１４への通電は製氷タイマー２０により制御され、所定時間経過後にしゃ断されて製氷運転が再開される。そして、このような繰返しにより製氷、脱氷運転が継続される。

【００２５】このようにして貯溜槽１１内には水１２の上部に徐々に氷ブロック２１が堆積する。この場合、製氷面から離脱する氷単体の体積として１００ｃｃ以下であることが好ましい。

【００２６】ここで、制御装置１９は夜間電力の使用を主たる目的に配置されており、所定の氷量が形成された後に冷凍装置１５の運転が停止され、その後不凍液循環ポンプ１８も停止する。特に貯溜槽１１内に氷が存在する状況からの製氷運転に際しては、事前に氷残量を検出あるいは算出し、所定量以上の製氷が行われないように制御される。

【００２７】以上のように本発明の第１の実施の形態においては、貯溜槽１１内の水１２中に製氷装置１３を設置し、かつ氷離脱時に製氷面１３ａに設けられた電気ヒータ１４により加熱してブロック状の氷を製氷面１３ａから離脱させるようにしたので、確実な氷の離脱性能を得ることができ、さらに製氷面１３ａへの水の供給が全く不要になると共に、製造した氷を浮力にて上昇させ、貯溜槽上部に堆積させることができる。

【００２８】従って、従来のハーベスト方式の氷蓄熱装置の最大の欠点であった製氷装置を貯溜槽上部に設置しなくてもよいので、設計自由度の高い、かつ簡潔な構成とすることができる。

【００２９】図３は本発明による氷蓄熱装置の第２の実施の形態を示す構成図である。図３において、３１は水３２が収容された貯溜槽で、この貯溜槽３１内の底部には複数の製氷装置３３が配置され、各製氷装置３３の不凍液の流入口及び流出口相互間が不凍液給排出管３４により接続されている。

【００３０】これら各製氷装置３３は図４に示すように全体が縦列方向に長形の箱形に形成され、その上面開口部に縦及び横方向にそれぞれ複数の矩形状の製氷面３３ａが形成された板面が設けられている。これら各製氷面３３ａはその部分の板面をそれぞれ内方へ凹ましたもので、不凍液による内圧が所定圧力を越えると板面全体が外方へ膨出するようになっている。

【００３１】一方、３５は貯溜槽３１の外部に設置された冷凍装置で、この冷凍装置３５と製氷装置３３との間を不凍液給排出管３４により接続して不凍液を循環させる不凍液循環系３６が形成されている。

【００３２】また、３７は貯溜槽３１より下流側の不凍液循環系３６に設けられた電動弁で、この電動弁３７は制御装置３８からの指令によりセットされ、所定時間の製氷運転終了を検知すると動作する製氷タイマー３９により閉制御される。

【００３３】さらに、４０は冷凍装置３５の不凍液入口側の不凍液循環系３６に設けられた不凍液循環ポンプで、この不凍液循環ポンプ４０の上流側の不凍液循環系３６にに不凍液溜め４１が設けられる。

【００３４】次に上記のように構成された氷蓄熱装置の作用について述べる。いま、制御装置３８からの指令により冷凍装置３５が運転されると共に、製氷タイマー３９がセットされると、冷凍装置３５より低温化された不凍液が不凍液循環ポンプ４０にて不凍液循環系３６を経由して各製氷装置３３に圧送される。

【００３５】すると、製氷装置３３の製氷面３３ａは不凍液給排出管３４より流入する不凍液により低温になり、凹部内の水を氷結させる。また、製氷タイマー３９が所定の製氷時間経過後に動作すると電動弁３７を閉じる。

【００３６】これにより、不凍液循環ポンプ４０上流側の不凍液循環系３６に設けられている不凍液溜め４１から不凍液の供給は継続されるが、電動弁３７が閉じているため、不凍液循環ポンプ４０の吐出圧により各製氷装置３３の内部への不凍液は供給され続ける。

【００３７】従って、各製氷装置３３の内部圧力が高まり、箱形の上面開口部に設けられた板面が外方に膨出し、製氷面３３ａに固着している氷ブロック４２が固着面から離脱し、氷ブロック４２が浮力により水中を浮上する。

【００３８】図４は変形前後の製氷面３３ａの状況を示す模式図であり、電動弁３７により堰止められた不凍液が製氷装置３３内に充満し、上面板が上方に膨出すると製氷面３３ａに形成された氷ブロック４２が離脱する状況である。

【００３９】この場合、電動弁３７は製氷タイマー３９により制御され、所定時間経過後に電磁弁３７への開指令が出され、製氷運転が再開される。そして、このような繰返しにより製氷、脱氷運転が継続される。

【００４０】このようにして貯溜槽３１内には水３２の上部に徐々に氷ブロック４２が堆積する。以上のように本発明の第２の実施の形態においては、貯溜槽３１内の水３２中に製氷装置３３を設置し、かつ氷離脱時に不凍液の圧力により製氷面３３ａを変形させてブロック状の氷を製氷面３３ａから離脱させるようにしたので、第１の実施の形態と同様の作用効果を得ることができる。

【００４１】なお、上記では製氷装置３３内の不凍液圧により上面板を上方に膨出させて製氷面３３ａから氷ブロック４２を離脱させるようにしたが、さらに氷ブロックの離脱性を高めるために第１の実施の形態で示した電気ヒータを併用することも可能である。

【００４２】この他、製氷装置の製氷面から氷を離脱させる手段としては、従来のハーベスト方式氷蓄熱装置に見られるように冷凍装置から製氷装置へ供給される低温

冷媒（例えばフロン等の冷凍サイクル作動媒体）を切替弁により冷凍装置の圧縮機より吐出する高温冷媒に切替えて製氷装置に供給することにより、製氷面を高温化して氷を離脱させるようにしてもよい。

【００４３】また、第１及び第２の実施の形態では、製氷タイマーにより氷の成長度合いを設定するようにしたが、実際に氷の成長を何等かの検知手段で検知し、この氷の大きさが所定の大きさになったことを検知したとき、氷を製氷面から離脱させるようにしてもよい。

【００４４】さらに、第１及び第２の実施の形態では、製氷装置の製氷面が垂直又は製氷面を上向きにして配置する構成について説明したが、図５に示すように複数個の製氷装置５３をそれぞれ斜め上方に傾斜させ、互いに重なり合わないように配置し、各製氷装置５３の不凍液の流入及び流出口を不凍液給排出管５４にそれぞれ接続するようにしてもよい。

【００４５】このような配置構成とすれば、貯溜槽内に製氷装置を高密度に設置することができる。また、第１及び第２の実施の形態では、製氷装置の製氷面の形状としてはブロック状の氷を生成する場合について説明したが、この他図６に示すように板状、棒状など、離脱性を改善できる範囲でその形状を変えるようにしてもよい。さらに、貯溜槽の上部空間に複数個の散水ノズルを設置すると共に、貯溜槽の底部に取水口を設けるようにしてもよい。

【００４６】

【発明の効果】以上述べたように本発明によれば、確実な氷の離脱性能を得ることが可能となるため、更に製氷面への水の供給が全く不要になると共に、製造した氷を浮力にて上昇させ貯溜槽の上部に堆積させることができる簡単な構成にして信頼性の高い氷蓄熱装置を提供できる。

【図面の簡単な説明】

【図１】本発明による氷蓄熱装置の第１の実施の形態を示す構成図。

【図２】同実施の形態における製氷装置の詳細を示す説明図。

【図３】本発明による氷蓄熱装置の第２の実施の形態を示す構成図。

【図４】同実施の形態における製氷装置の詳細を示す説明図。

【図５】本発明の他の実施の形態における製氷装置の配置構成図。

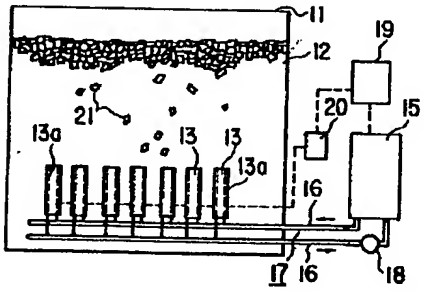
【図６】本発明の他の実施の形態における製氷装置の製氷面の形状を示す図。

【図７】従来のハーベスト方式の氷蓄熱装置を示す構成図。

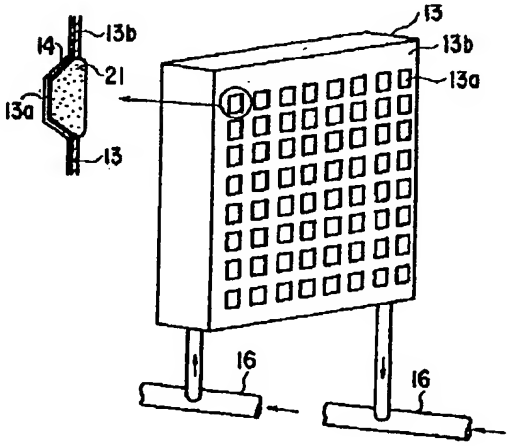
【符号の説明】

１１，３１……貯溜槽
１２，３２……水
１３，３３……製氷装置
１３ａ，３３ａ……製氷面
１３ｂ……断熱層
１４……電気ヒータ
１５，３５……冷凍装置
１６，３４……不凍液給排出管
１７，３６……不凍液循環系
１８，４０……不凍液循環ポンプ
１９，３８……制御装置
２０，３９……製氷タイマー
３７……電動弁
４１……不凍液溜め

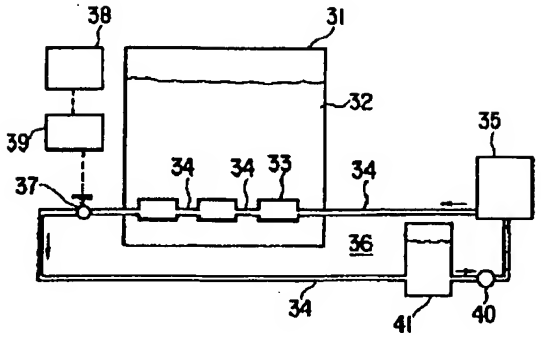
【図１】



【図２】



【図３】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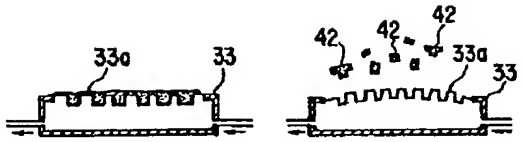
【図４】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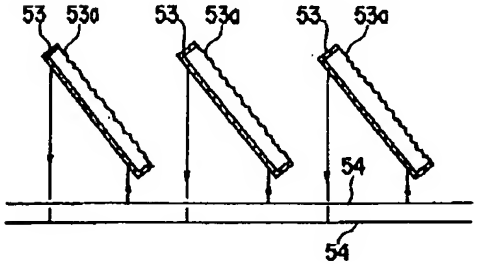
33

【図５】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53a
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53a
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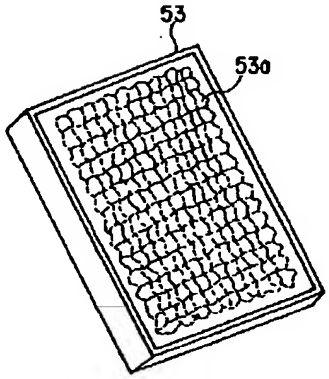
54

【図６】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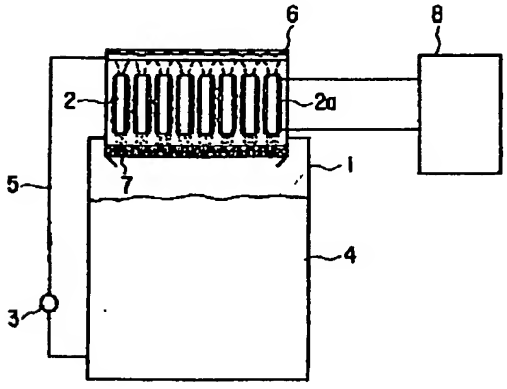
【図７】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ENGLISH TRANSLATION

PATENT ABSTRACTS OF JAPAN

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(71)Applicant : TOSHIBA CORP
(22)Date of filing : 12.06.1996
(72)Inventor : WATANABE YUTAKA

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(54) ICE COLD HEAT STORAGE APPARATUS

(57)Abstract:
PROBLEM TO BE SOLVED: To simplify a constitution by disposing a plurality of icemakers at a bottom of a reservoir in case of making ice by freezing water in the reservoir in the icemakers, freezing the water in the reservoir at their icemaking surfaces to make ice, thereby raising the made ices by buoyancy and depositing it at a upper part of the reservoir.
SOLUTION: When a refrigerator 15 is operated by a command from a controller 19 and an icemaking timer 20 is started, an antifreeze solution lowered at its temperature by the refrigerator 15 is pumped to respective icemakers 13 via an antifreeze solution discharge tube 16 by an antifreeze solution circulation pump 18. Then, icemaking surfaces 13a of the icemakers 13 become a low temperature at the solution to freeze up water 12 at a periphery of a recess. When the timer 20 is operated after a predetermined icemaking time is elapsed, electric heaters arranged on the respective surfaces 13a are energized. Thus, fixed surfaces of ice blocks 21 fixed to the

respective surfaces 13a are melted, the blocks 21 are released from the surfaces 13a and floated in water. Thus, the blocks 21 are gradually deposited in an upper part in a reservoir 11.

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[Date of sending the examiner's decision of rejection]
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] Ice thermal storage equipment characterized by manufacturing ice, installing each ice plant in the pars basilaris ossis occipitalis of said reservoir in the ice thermal storage equipment which secedes from ice plant according to that growth, and stores this ice in said reservoir, making that ice-making side to freeze the water held in the reservoir with two or more ice plant, and freeze the water in said reservoir, and manufacturing ice.
[Claim 2] Ice-thermal-storage equipment characterized by forming an electric heating means in the ice-making side of each ice plant, carrying out fixed time amount actuation of said electric heating means on condition that the magnitude of said ice manufactured in respect of ice making detected having grown up to be predetermined magnitude or predetermined ice-making operation time passed, heating an ice-making side in ice thermal storage equipment according to claim 1, and making it secede from ice.
[Claim 3] Two or more ice plant which has the ice-making side which can bulge in the method of outside when the pressure of the antifreezing solution which is installed in the pars basilaris ossis occipitalis of the reservoir in which water was held, and this reservoir, and flows into the interior turns into a predetermined pressure, The freezer with which the antifreezing-solution circulatory system which it is installed [circulatory system] in the exterior of said reservoir and circulates the antifreezing solution between said ice plant was formed, It has the valve prepared in said ice plant outlet side of said antifreezing-solution circulatory system, and the antifreezing-solution circulating pump formed in the antifreezing-solution inflow side of said freezer of said antifreezing-solution circulatory system. On condition that made the ice-making side of each ice plant freeze the water in said reservoir, ice was manufactured, and it detected that the magnitude of this

ice grew up to be predetermined magnitude or predetermined ice-making operation time passed, the close by-pass bulb completely of said valve is carried out. Ice thermal storage equipment characterized by bulging the ice-making side of said ice plant in the method of outside with the discharge pressure of said antifreezing-solution circulating pump, and making ice secede from an ice-making side.

[Claim 4] Ice thermal storage equipment characterized by having faced installing two or more ice plant in the pars basilaris ossis occipitalis of a reservoir in ice thermal storage equipment given in the term of what gap of claim 1 thru/or claim 3, and installing each ice plant so that it may not overlap perpendicularly mutually.

[Claim 5] Ice thermal storage equipment which faces installing two or more ice plant in the pars basilaris ossis occipitalis of a reservoir in ice thermal storage equipment given in the term of what gap of claim 1 thru/or claim 4, and makes only one side of each ice plant an ice-making side, and is characterized by installing by turning this ice-making side upward.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention manufactures iced water available as a low-temperature heat source using the relatively cheap power of Nighttime, and relates to the ice thermal storage equipment of the HARVEST method (it carries out by repeating icy manufacture and deice with ice plant) which performs economical air-conditioning and cold energy supply by storing this in a reservoir.

[0002]

[Description of the Prior Art] The ice thermal storage equipment of the conventional HARVEST method installs ice plant in the upper part of an ice-making tub. Pump up water from a reservoir continuously, sprinkle the low-temperature ice-making side installed perpendicularly, and ice is grown up. It uses the ice-making technique which reverses ice plant and carries out fall balking of the ice while after icy growth warms an ice-making side, and it warms this after it supplies water to the method which tabular ice is dropped and stores it, and a dished ice-making machine and uses it as ice.

[0003] Drawing 7 shows the example of a configuration of the ice thermal storage equipment of this conventional HARVEST method, 1 is the reservoir in which ice is made to store, and ice plant 2 is installed in the upper part of this reservoir 1. The ice grinding equipment 7 which the ice which the sprinkler system 6 which supplies the water 4 pumped out with the water cycle pump 3 from the pars basilaris ossis occipitalis of a reservoir 1 through piping 5 to the upper part of this ice plant 2 has been arranged, and manufactured ice in the lower part is ground [equipment], and drops a

reservoir 1 is arranged.
[0004] Moreover, this ice plant 2 is connected so that a circuit may be formed in a freezer 8, and the water around ice-making side 2a which sprinkled from the sprinkler system 6 with the low-temperature-ized antifreezing solution which is supplied from this freezer 8 is frozen.
[0005] Therefore, if it is in the ice thermal storage equipment of such a configuration, the tabular ice which fell with gravity from ice-making side 2a is scattered [having a clearance between mutual ice] while it is subdivided by ice grinding equipment 7 and it carries out fall deposition in the upper part of a reservoir 1. Consequently, on the occasion of a thaw, the passage of countless water is formed between ice, and since very good heat exchange is attained, it has the advantage which is stabilized and can take out low-temperature cold water.
[0006]
[Problem(s) to be Solved by the Invention] However, with such ice thermal storage equipment of the conventional HARVEST method, since the ice manufactured by ice-making side 2a of ice plant 2 is dropped to the reservoir 1 with gravity, it is necessary to install ice plant 2 in the upper part of a reservoir 1, and there are many problems, such as receiving a tooth-space-limit.
[0007] That is, the installation tooth space of ice grinding equipment 7 is further needed for the lower part with the installation tooth space of the about [3m] ice plant 2 in the upper part of the ice-making tub 1. Moreover, since the ice-making side turnover device for dropping ice etc. is needed in the ice grinding equipment 7 which subdivides ice is needed when the piping 5 for supplying water to ice-making side 2a of ice plant 2, the water cycle pump 3, and the ice generated by ice-making side 2a are tabular, and generating the ice of the letter of a block, there is a problem in respect of tooth-space nature and energy-saving nature.
[0008] Furthermore, it is in a situation next to impossible to convert the existing water accumulator into ice thermal storage equipment from the need of installing ice plant 2 and ice grinding equipment 7 in the upper part of a reservoir 1. the configuration which the manufactured ice can be raised by buoyancy and can be made to deposit on the upper part of a reservoir while this invention solves the above problems, the balking engine performance of positive ice is obtained and the supply of water to an ice-making side completely becomes unnecessary further -- it aims at offering easy and reliable ice thermal storage equipment.
[0009]
[Means for Solving the Problem] This invention constitutes ice thermal storage equipment with the following means in order to attain the above-mentioned purpose. Invention corresponding to claim 1 manufactures ice, installs each ice plant in the pars basilaris ossis occipitalis of said reservoir, makes that ice-making side to freeze the water held in the reservoir with two or more ice plant, and freeze the water in said reservoir in the ice thermal

storage equipment which secedes from ice plant according to that growth, and stores this ice in said reservoir, and manufactures ice.

[0010] Therefore, since water is automatically supplied after ice surfaces, while this ice will surface according to a consistency difference (buoyancy), if ice is manufactured with the ice plant installed in underwater [of a reservoir pars basilaris ossis occipitalis] if it was in the ice thermal storage equipment of invention corresponding to above-mentioned claim 1, the sprinkler nozzle for a thaw in the reservoir upper part is set aside, and all structures become unnecessary. This becomes convertible [from the existing water accumulator] to ice thermal storage equipment, and offer of space-efficient HARVEST method ice thermal storage equipment is possible for it with new ice thermal storage equipment.

[0011] Invention corresponding to claim 2 heats an ice-making side with said electric heating means, on condition that the electric heating means was formed in the ice-making side of each ice plant, and the magnitude of said ice manufactured in respect of ice making detected having grown up to be predetermined magnitude or predetermined ice-making operation time passed, and it makes it secede from ice in invention corresponding to claim 1.

[0012] Two or more ice plant which has the ice-making side which can bulge in the method of outside when the pressure of the antifreezing solution which invention corresponding to claim 3 is installed in the pars basilaris ossis occipitalis of the reservoir in which water was held, and this reservoir, and flows into the interior turns into a predetermined pressure, The freezer with which the antifreezing-solution circulatory system which it is installed [circulatory system] in the exterior of said reservoir and circulates the antifreezing solution between said ice plant was formed, It has the valve prepared in said ice plant outlet side of said antifreezing-solution circulatory system, and the antifreezing-solution circulating pump formed in the antifreezing-solution inflow side of said freezer of said antifreezing-solution circulatory system. On condition that made the ice-making side of each ice plant freeze the water in said reservoir, ice was manufactured, and it detected that the magnitude of this ice grew up to be predetermined magnitude or predetermined ice-making operation time passed, the close by-pass bulb completely of said valve is carried out. The ice-making side of said ice plant is bulged in the method of outside with the discharge pressure of said antifreezing-solution circulating pump, and ice is made to secede from an ice-making side.

[0013] If it is in the ice thermal storage equipment of invention corresponding to above-mentioned claim 2 and claim 3 Since it has a means to make an ice-making side heat electrically, or the means made to transform an ice-making side mechanically (it swells) as a means to make the ice manufactured with ice plant secede from an ice-making side The problem of the balking nature of the ice generated by installing ice plant underwater can also be solved, and it becomes possible to make ice secede from an ice-making side certainly.

[0014] In invention given in the term of what gap of claim 1 thru/or claim 3, invention corresponding to claim 4 is faced installing two or more ice plant in the pars basilaris ossis occipitalis of a reservoir, and it installs each ice plant so that it may not overlap perpendicularly and mutually.
[0015] In invention corresponding to the term of what gap of claim 1 thru/or claim 4, invention corresponding to claim 5 is faced installing two or more ice plant in the pars basilaris ossis occipitalis of a reservoir, and makes only one side of each ice plant an ice-making side, and turns this ice-making side upward, and installs.
[0016] It can be made to rise to surface smoothly, without checking the ice which surfaces from each ice plant since it arranges so that ice plant may not be lapped perpendicularly mutually, also in case the ice which seceded from ice plant if it was in the ice thermal storage equipment of invention corresponding to above-mentioned claim 4 and claim 5 goes up by buoyancy underwater with ice plant.
[0017]
[Embodiment of the Invention] The gestalt of operation of this invention is explained with reference to a drawing below. Drawing 1 is the block diagram showing the gestalt of operation of the 1st of the ice thermal storage equipment of the HARVEST method by this invention.
[0018] In drawing 1 , 11 is the reservoir in which water 12 was held, and two or more ice plant 13 is installed in the pars basilaris ossis occipitalis in this reservoir 11 side by side, respectively. As each [these] ice plant 13 is shown in drawing 2 R> 2, the whole is formed in a cube type, and ice-making side 13a of the shape of two or more rectangle is formed in the length and the longitudinal direction of the order both sides, respectively.
[0019] As for each [these] ice-making side 13a, the plate surface of the part is prepared in the electric heater 14 by concave, furthermore its inner skin to the method of inside, respectively. Moreover, the thin film which has **** cone water repellence like the film of polypropylene in the front face of ice-making side 13a is pasted up or coated, and icy balking nature is promoted.
[0020] On the other hand, 16 is the antifreezing-solution supply and exhaust conductor which supplies and discharges the antifreezing solution inside [ice plant 13] each, and while feeding-and-discarding opening of each ice plant 13 is connected to this antifreezing-solution supply and exhaust conductor 16, the antifreezing-solution circulatory system 17 which it connects [circulatory system] with the freezer 15 installed outside, and circulates the antifreezing solution is formed. Moreover, the antifreezing-solution circulating pump 18 is formed in the antifreezing-solution circulatory system 17 by the side of the antifreezing-solution inflow of a freezer 15.
[0021] Moreover, the control unit with which 19 controls operation of a freezer 15 and the electric heater 14 of each ice plant 13, and 20 are ice-making timers which turn on the electric heater 14 of each ice plant 13 with a fixed time interval, and are turned off by the command from this control unit 19.

[0022] Next, an operation of the ice thermal storage equipment constituted as mentioned above is described. If the ice-making timer 20 is started while a freezer 15 is now operated by the control command from a control unit 19, the low-temperature-ized antifreezing solution will be fed by each ice plant 13 via the antifreezing-solution supply and exhaust conductor 16 with the antifreezing-solution circulating pump 19 from a freezer 15.
[0023] Then, ice-making side 13a of ice plant 13 becomes low temperature with the antifreezing solution which flows from the antifreezing-solution supply and exhaust conductor 16, and freezes the water 12 of a crevice inner circumference enclosure. Moreover, if the ice-making timer 20 operates after predetermined ice-making time amount progress, the electric heater 14 arranged in each ice-making side 13a will energize.
[0024] The root face of the ice block 21 which has fixed to each ice-making side 13a dissolves by this, and the ice block 21 secedes from ice-making side 13a by buoyancy, and surfaces underwater. In this case, the energization to an electric heater 14 is controlled by the ice-making timer 20, it is broken after predetermined time progress, and ice-making operation is resumed. And ice making and deice operation are continued by such repetition.
[0025] Thus, in a reservoir 11, the ice block 21 deposits on the upper part of water 12 gradually. In this case, it is desirable that it is 100 cc or less as volume of the ice simple substance which secedes from an ice-making side.
[0026] Here, use of the Nighttime power is arranged at the main purpose, after predetermined ice concentration is formed, operation of a freezer 15 is suspended, and the antifreezing-solution circulating pump 18 also suspends a control unit 19 after that. It faces from the situation that ice exists especially in a reservoir 11 to ice-making operation, and an ice residue is detected or computed in advance, and it is controlled so that ice making more than the specified quantity is not performed.
[0027] It sets in the gestalt of operation of the 1st of this invention as mentioned above. Since it heats by the electric heater 14 which installed ice plant 13 into the water 12 in a reservoir 11, and was prepared in ice-making side 13a at the time of ice balking and was made to make the ice of the letter of a block secede from ice-making side 13a While the balking engine performance of positive ice can be obtained and supply of the water to ice-making side 13a completely becomes unnecessary further, the manufactured ice can be raised by buoyancy and it can be made to deposit on the reservoir upper part.
[0028] Therefore, since it is not necessary to install the ice plant which was the greatest fault of the ice thermal storage equipment of the conventional HARVEST method in the reservoir upper part, it can consider as a brief configuration highly [a design degree of freedom].
[0029] Drawing 3 is the block diagram showing the gestalt of operation of the 2nd of the ice thermal storage equipment by this invention. In drawing 3 , 31 is the reservoir in which water 32 was held, two or more ice plant 33 is arranged at the pars basilaris ossis occipitalis in this reservoir 31, and the

input of the antifreezing solution of each ice plant 33 and between tap holes are connected by the antifreezing-solution supply and exhaust conductor 34.
[0030] The plate surface by which the whole was formed in the direction of a column at the cube type of a long form as each [these] ice plant 33 was shown in drawing 4 , and ice-making side 33a of the shape of two or more rectangle was formed in the top-face opening in length and a longitudinal direction, respectively is prepared. Each [these] ice-making side 33a is what dented the plate surface of the part to the method of inside, respectively, and if the internal pressure by the antifreezing solution exceeds a predetermined pressure, the whole plate surface bulges to the method of outside.
[0031] On the other hand, 35 is the freezer installed in the exterior of a reservoir 31, and the antifreezing-solution circulatory system 36 which between this freezer 35 and ice plant 33 is connected [circulatory system] by the antifreezing-solution supply and exhaust conductor 34, and circulates the antifreezing solution is formed.
[0032] Moreover, 37 is the motor-operated valve prepared in the antifreezing-solution circulatory system 36 of the downstream from the reservoir 31, and this motor-operated valve 37 is set by the command from a control unit 38, and is closed-controlled by the ice-making timer 39 which will operate if ice-making operation termination of predetermined time is detected.
[0033] furthermore, 40 is the antifreezing-solution circulating pump formed in the antifreezing-solution circulatory system 36 of the antifreezing-solution entrance side of a freezer 35, the antifreezing-solution circulatory system 36 of the upstream of this antifreezing-solution circulating pump 40 is resembled, and the antifreezing-solution reservoir 41 is formed.
[0034] Next, an operation of the ice thermal storage equipment constituted as mentioned above is described. If the ice-making timer 39 is set while a freezer 35 is now operated by the command from a control unit 38, the low-temperature-ized antifreezing solution will be fed by each ice plant 33 via the antifreezing-solution circulatory system 36 with the antifreezing-solution circulating pump 40 from a freezer 35.
[0035] Then, ice-making side 33a of ice plant 33 becomes low temperature with the antifreezing solution which flows from the antifreezing-solution supply and exhaust conductor 34, and freezes the water in a crevice. Moreover, if the ice-making timer 39 operates after predetermined ice-making time amount progress, a motor-operated valve 37 will be closed.
[0036] Although supply of the antifreezing solution is continued by this from the antifreezing-solution reservoir 41 prepared in the antifreezing-solution circulatory system 36 of the antifreezing-solution circulating-pump 40 upstream, since the motor-operated valve 37 has closed, it is continued by supplying the discharge pressure of the antifreezing-solution circulating pump 40 the antifreezing solution inside each ice plant 33.
[0037] Therefore, the internal pressure of each ice plant 33 increases, the plate surface prepared in top-face opening of a cube type bulges in the

method of outside, the ice block 42 fixed to ice-making side 33a secedes from a root face, and the ice block 42 surfaces underwater by buoyancy.
[0038] Drawing 4 is the mimetic diagram showing the situation of ice-making side 33a before and behind deformation, and when the weir stop **** antifreezing solution is full in ice plant 33 with a motor-operated valve 37 and a top-face plate bulges up, it is in the situation from which the ice block 42 formed in ice-making side 33a secedes.
[0039] In this case, a motor-operated valve 37 is controlled by the ice-making timer 39, the open command to a solenoid valve 37 is issued after predetermined time progress, and ice-making operation is resumed. And ice making and deice operation are continued by such repetition.
[0040] Thus, in a reservoir 31, the ice block 42 deposits on the upper part of water 32 gradually. Since install ice plant 33 into the water 32 in a reservoir 31, and ice-making side 33a is made to transform with the pressure of the antifreezing solution at the time of ice balking and it was made to make the ice of the letter of a block secede from ice-making side 33a in the gestalt of operation of the 2nd of this invention as mentioned above, the same operation effectiveness as the gestalt of the 1st operation can be acquired.
[0041] In addition, although a top-face plate is bulged up by ******** in ice plant 33 above and it was made to make the ice block 42 secede from ice-making side 33a, in order to raise the balking nature of an ice block further, it is also possible to use together the electric heater shown with the gestalt of the 1st operation.
[0042] In addition, an ice-making side is elevated-temperature-ized and you may make it make it secede from ice by changing from a freezer to the elevated-temperature refrigerant which carries out the regurgitation of the low-temperature refrigerant (for example, refrigerating cycle actuation media, such as chlorofluocarbon) supplied to ice plant from the compressor of a freezer by the selector valve, and supplying ice plant so that conventional HARVEST method ice thermal storage equipment may see as a means to make it secede from ice, from the ice-making side of ice plant.
[0043] Moreover, when icy growth is actually detected with a certain detection means and it detects that the magnitude of this ice turned into predetermined magnitude, you may make it make ice secede from an ice-making side with the gestalt of the 1st and the 2nd operation, although the icy growth degree was set up by the ice-making timer.
[0044] Furthermore, although the gestalt of the 1st and the 2nd operation explained the configuration whose ice-making side of ice plant turns a perpendicular or an ice-making side upward, and arranges it, two or more ice plant 53 is made to incline in the slanting upper part, respectively, as shown in drawing 5 , and it arranges so that it may not overlap mutually, and you may make it connect an inflow and tap hole of the antifreezing solution of each ice plant 53 to the antifreezing-solution supply and exhaust conductor 54, respectively.
[0045] Ice plant can be installed in such an arrangement configuration, then

a reservoir at high density. Moreover, although the gestalt of the 1st and the 2nd operation explained the case where the ice of the letter of a block was generated as a configuration of the ice-making side of ice plant, you may make it the shape of tabular and a rod etc. change the configuration in the range which can improve balking nature, as shown in drawing 6 . Furthermore, while installing two or more sprinkler nozzles in the up space of a reservoir, you may make it establish an intake in the pars basilaris ossis occipitalis of a reservoir.

[0046]

[Effect of the Invention] Since it becomes possible to obtain the balking engine performance of positive ice according to this invention as stated above, while the supply of water to an ice-making side completely becomes unnecessary further, it is made the easy configuration which the manufactured ice can be raised by buoyancy and can be made to deposit on the upper part of a reservoir, and reliable ice thermal storage equipment can be offered.
